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album Greene. The paper was illustrated by herbarium material and by samples of the flowers of each species preserved in formalin. While the main characters lie in the shape of the calyx and corolla tube, the habit and foliage of the plant afford good diagnostic points.

Mr. O. F. Cook discussed certain new or little known species of *Amanita*, commenting on their structure and relationships.

The ninth regular meeting of the Club was held September 6, 1899, and was devoted to an informal account of the Alaskan flora by Mr. Frederick V. Coville, who was a member of the Harriman expedition.

CHARLES LOUIS POLLARD,
Secretary.

DISCUSSION AND CORRESPONDENCE.

ON THE DEFINITION OF GEOLOGICAL TERRANES.

SURPRISING as it may seem to those who are not professional geologists, it nevertheless with truth may be said that until within the last decade or two there existed little demand for the concise definition of geological terranes and formations. The mere application of a name was almost enough to establish it. In this connection there was often also an enumeration of the common fossils contained, or a somewhat generalized vertical section of the rock layers. One or the other of these features and a knowledge of the typical locality at which the rocks were exposed often enabled the terrane to be subsequently recognized and the title to be used.

At the present time all is changed. With the systematic introduction of local geographic names for the geological terranes, and the general adoption of criteria of discrimination other than those afforded by fossils, there has come to exist an urgent need for more accurate definition of terms. The degree of accuracy now demanded is comparable to that attained in other branches of science. The requirement is for definition based not on trivial or accidental characters, but upon features that are not only really determinative, but recognizable in the field.

The classes of characteristics that require attention are not many, yet in the description of

geological terranes it rarely happens that any of these features are clearly pointed out, or when mention is made of them that they are equally compared. When a new name of a rock terrane is formally proposed, about the least thing that its author can do, if he wishes his term to be considered by his fellow workers, is to tabulate the leading characteristics and differences as compared with associated terranes.

In the past there has been little or no necessity for very exact discrimination; hence in using the title suggested by the workers of a generation or more ago we have to do the best we can, giving the pioneers the benefit of all doubts. When titles are applied to terranes now there is cogent demand for formal enumeration of essential features.

Exactly what should constitute a proper definition of a geological terrane may give rise to some differences of opinion. But there should be no variance of views regarding what points should be especially mentioned. Little or no attempt has yet been made to formulate these groups of essential characteristics. They appear, however, to fall naturally under six categories, which may be termed: (1) geographic distribution, (2) topographic expression, (3) lithologic nature, (4) stratigraphic delimitation, (5) biologic definition, and (6) economic content.

1. *Geographic Distribution* is of first importance, as it fixes the terrane in space. The actual area occupied, or the amount of territory over which it forms the surface rock, is largely a function of the present attitude of the rocks. When the beds are horizontal, or nearly so, the surface distribution closely coincides with the original lateral extent. The area occupied is broad. As the degree of tilting increases, owing to orogenic movement that took place after the sediments were laid down, there is a narrowing of the zone until, when the strata stand vertically, it reaches a minimum breadth.

In the definition of a geological terrane the matter of geological distribution is not only of much greater import than it was formerly supposed to be, but it is a factor that is constantly becoming more valuable for the reason that rock units are now being named after

prominent geographic features that are situated within their borders.

2. *Topographic Expression*.—While the surface relief, or topographic expression, of various regions has received more or less consideration in the past, its great variety and characteristic types have been only vaguely connected with the structure and composition of the underlying rocks. Only recently has the interpretation of topography found a philosophical foundation. Only within the last few years has arisen a entirely new department of geological inquiry. The rapid development of this new science of geomorphy, or geographic geology, has given a new meaning to stratigraphy, and therewith has furnished a reliable criterion for determining and mapping geological formations that was wholly unthought of before. General topographic expression may be now regarded as one of the most important and distinctive attributes of geological terranes.

When its topographical type and peculiarities are clearly discerned a terrane may be, with frequent checks from other sources, traced many miles with rapidity and certainty, from horseback, or often even from the swiftly moving railway train.

As the differences in the topography of a region are dependent primarily on the relative power of resistance to erosion that the several contiguous layers possess, there is usually a close relationship existing between this feature and the other characteristics which have been heretofore generally considered alone in connection with stratigraphy. Thus, an extensive shale bed will often be worn down to a lowland plain, while the limestone or sandstone strata on either side of the belt will form ridges. The faunas in shales are usually peculiar to them, and very distinct from lithologically different beds. Again, a limestone which forms the hard member with the soft shales is, when intercalated with crystallines, itself the soft member and constitutes the valleys.

Although the same kinds of beds may produce directly the opposite phases of topographic expression, for each particular region the phase assumed is distinctive and generally extends throughout the geographical extent of the terrane.

3. *Lithologic Nature*.—In the early part of the century it was customary to regard lithological characteristics as the most important features in the recognition of geological formations. In correlating deposits more or less widely separated, this character was depended upon, to the exclusion of all others. At a later date, when other criteria were applied, the determinations which had been made upon purely lithological grounds were found to be so faulty and unreliable that the use of this feature finally came to be ignored almost altogether. Of late, the real value of the lithologic factor is beginning to be more fully appreciated. It is certainly as trustworthy as the faunal characteristics of a terrane, and, in addition, is generally of wider application.

The lithology of a geological formation, outside of the massive rocks, is largely a function of the attitude of the adjoining land areas at the time that the beds were laid down. Hence, there is a close connection between the local character of the forming strata and the position of the adjacent land as changing under the influence of diastatic movement. In noting the distinguishing characters of a terrane the lithology should receive the fullest consideration and the most careful discrimination.

4. *Stratigraphic Delimitation*.—Until very recently little attention has been paid to the exact vertical or range limits of geological terranes. In an indefinite and incidental way they have been often fixed within narrow bounds, and the local features explained for the typical locality; but farther than this most descriptions are stratigraphically inexact.

The determination of definite, easily recognizable upper and lower horizons, that are readily traceable over considerable areas, are of prime importance, not only to have a compact, natural unit, but on account of presenting reliable features for the correlation in different parts of the geologic province. The division line between terranes is not always equally distinct and prominent throughout the areal extent of the deposit, and different criteria have often to be resorted to in different parts of a province.

While the exact position of a terrane in the general geological scale is not always to be made out with exactness at first, its approxi-

mate equivalents in well-known sections may be pointed out. The exact location in the general vertical section of the region in which it lies must, of necessity, be determined sufficiently near to enable future recognition.

5. *Biologic Definition.*—The value of the fossils contained in a terrane varies greatly with the size of the succession of strata considered. The rapid replacement of faunas in local successions enables a number of zones to be made out, each of which is characterized by certain forms which predominate. From the purely paleontological standpoint this enables the strata to be subdivided in great detail. However, the real geological relations of the terranes are lost sight of almost entirely. Without going into details, there are ordinarily certain characteristic faunal or floral phases which constitute important features by which terranes may be distinguished from one another, or which, at least, greatly aid in this determination, especially when taken in connection with the criteria. Each terrane may be regarded as possessing biotic characters which should be clearly set forth.

6. *Economic Content.*—In the practical delimitation of a geological terrane, and in tracing it over a considerable area, the ore or mineral deposits of commercial value that are contained form valuable determinative factors that are rarely taken into consideration; or, at least, in the descriptions of formations little note is ordinarily made of them. While with many, if not most terranes, the contained ores are not original depositions, but are secondarily acquired long after the rocks in which they occur were laid down, they are, nevertheless, of such peculiar organization and composition that they are seldom found either in the layers above or below. Furthermore, a rock terrane may be traced for long distances by the occurrences of valuable deposits along the line of the outcrop, or it may be recognizable by these alone over broad areas in which other characters of the terrane give no evidence of its existence. In correlating exposures somewhat widely separated, it is often only through the economic contents that a reliable clue is given to their identity.

CHARLES R. KEYES.

ZOOLOGICAL NOTES.

THE collection of birds formed by H. E. Dresser and constituting the basis for his work on the 'Birds of Europe and Monographs of the Rollers and Bee-Eaters' has been presented to the Manchester Museum, England, by a friend who wishes to remain anonymous. Something over 1,000 species are represented, by about 10,000 specimens, illustrating differences of plumage due to age, sex and locality, all carefully labelled.

HITHERTO the turkey buzzard has pursued a peaceful, if malodorous existence, unharmed by the whims of fashion, but this quiet has been disturbed by the present demand for eagle feathers for ladies hats. The supply of eagles is not equal to the demand, and as Ulysses is said to have eked out the skin of the lion by using that of the fox, so dealers substitute the primaries of the turkey buzzard for those of the eagle.

THE last report of the Royal Zoological Society of Amsterdam commemorates the sixtieth year of its existence and briefly reviews the more important events in its career. Besides the well-known zoological garden the society maintains a fine aquarium, zoological museum, museum of paleontology and geology, ethnographical museum, and library, a combination which affords fine facilities for scientific work. It will be remembered that Fürbinger's monumental work on the morphology of birds was among the publications of this society. The amount of food consumed by the animals is rather appalling, but the long list of members which closes the report shows the abundant resources of the Society. The 'sport mania' is deplored as being largely responsible for the extermination of large mammals, and, among other items, it is noted that no less than fourteen African elephants were born in the gardens.

F. A. L.

RECENT ZOO-PALEONTOLOGY.

DR. MAX SCHLOSSER, of Munich, contributes to a recent number of the *Palæontographica* a very important article upon the origin of the bears. Setting aside the generally accepted hypothesis of Gaudry, that *Ursus* sprang from *Hyænarctos* and that from *Amphicyon*, he traces